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APPLICATION TITLE: A METHOD AND DEVICE FOR COMBUSTING LIQUID FUELS

EXAMINER: ALFRED BASICHAS, ART UNIT 3749

INVENTORS: DEON JHON POTGIETER, ET. AL.

APPELLANT'S BRIEF

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REAL PARTIES IN INTEREST:

The real party in interest is Associated Physics of America, LLC a limited liability company registered in the state of Mississippi. The named inventors Deon John Potgieter and Billy F. Hopper have executed written assignments of all rights, title and interest to the present application to Associated Physics of America, LLC. These assignments have been recorded with the U.S. Patent Office.

RELATED APPEALS AND INTERFERENCES

APPELLANT DOES NOT HAVE ANY PRIOR PENDING APPEALS OR INTERFERENCES RELATING TO OR HAVING ANY BEARING ON THIS APPEAL.

STATUS OF CLAIMS

1. (currently amended)

2. (currently amended)

3. (withdrawn)

4. (currently amended)

5. (withdrawn)

6. (previously presented)

7. (previously presented)

8. (canceled)

9. (previously presented)

10. (currently amended)

11. (currently amended)

12. (currently amended)

13. (withdrawn)

14. (canceled)

15. (canceled)

16. (withdrawn)

17. (withdrawn)

18. (withdrawn)

19. (withdrawn)

20. (withdrawn)

21. (currently amended, withdrawn)

22. (withdrawn)

23. (canceled)

24. (currently amended)

25. (previously presented)

26. (previously presented)

Applicant appeals the rejection of Claims 1 through 7, 9 through 12, and 21 through 26.

STATUS OF AMENDMENTS

NO AMENDMENTS HAVE BEEN FILED BY APPELLANT OR ENTERED IN THIS APPLICATION AFTER THE NOTICE OF APPEAL WAS FILED.

SUMMARY OF CLAIMED SUBJECT MATTER

The invention presents a method and device that effectively combusts heavy hydrocarbon fuel oils by injecting them through a zone of combusting hydrogen where the oil is finely dispersed, partially vaporized and ignited. The zone of combusting hydrogen is formed by generating hydrogen and oxygen gas from an external electrolytic cell and piped to a plurality of nozzles on the burner's front face. The outlet ports of these nozzles point toward the axial center of the burner face. The hydrogen and oxygen gas flowing out of these ports is then ignited to produce relatively short flame jets having the tips meet along the axis of the burner. The burner head is then rotated at relatively high speed. Under rotation, the individual hydrogen gas flames form wrap together into a conical-shaped flame zone. The fuel oil can be mixed with water or steam and sprayed directly into the combusting hydrogen flame zone. The intense heat and turbulence inside the hydrogen flame zone serves to further disperse and vaporize the heavy fuel oil to promote the oil's combustion. The presence of water or steam also catalyzes a reforming reaction on contact with the hydrogen flame fronts. The hydrogen flame cone also continuously ignites the combusting oil, which forms a second fuel flame downstream of the hydrogen flame zone. The hydrogen flame zone remains stable while the

fuel/water/steam mixture is sprayed through it due the unique properties of hydrogen gas (i.e., fast flame speed).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether the use of the words "first" and "second," added to Claim 1 by amendment during prosecution, have support in the specification sufficient to satisfy the enablement requirement of 35 U.S.C. §112?

2. Whether the Houseman reference shows all of the limitations of the present invention sufficiently to support a rejection of claims 1, 2, 5, 9, 11, and 12 under 35 U.S.C. §102(b)?

3. Whether the method set forth in claims 3, 4, and 6 of the present invention are obvious modifications of the Houseman reference and properly rejected under 35 U.S.C. §103?

ARGUMENTS

1. Whether the use of the words "first" and "second," added to Claim 1 by amendment during prosecution, have support in the specification sufficient to satisfy the enablement requirement of 35 U.S.C. §112?

The Examiner contends that the specification as filed does not adequately contain description of the "first" and "second" combustion zones referred to in Claim 1. These words were added by amendment during prosecution in an effort to assist the Examiner in understanding what the specification, as filed, set forth. The words "first" and "second" denote distinction and sequence. Distinction means they are separate. Sequence means one occurs before the other. These words do not constitute "new matter" because the specification, as originally filed, is replete with statements clearly showing that the combustions zones referred to in Claim 1 are distinct and in sequence.

- Paragraph 0012, line 4 - "A simplified representation of the *hydroxy and fuel oil combustion zones* is shown..." (emphasis added).
- Figure 1, Items 10 and 11b - drawing lines define separate areas for these zones.
- Paragraph 0020, lines 4-9. These lines state the sequence: 1) establish the hydrogen flames, 2) rotating

the flames about the central axis, and 3) flowing a primary fuel into the hydrogen combustion zone.

- Paragraph 0021, lines 9-11. These lines refer to a "downstream" zone 11b which is the primary fuel combustion zone. "Downstream" is relative to the hydrogen combustion zone, which denotes both separation and sequence.
- Paragraph 0021, lines 13-14. These lines are part of a sentence describing the primary fuel combustion as taking place without interference with by the hydrogen combustion zone (i.e., they are distinct).
- Abstract, lines 4-6. Summarizing the claimed method sequence of establishing a zone of combusting hydrogen (i.e., first) and projecting a primary fuel into that combusting hydrogen zone (i.e., second).
- Original Claim 1. A method claim listing a sequence of steps in which the first listed step is "establishing a zone of combusting hydrogen." The second listed step is to inject the primary fuel into the zone created in the first listed step.

In the present application, the word "first" in relation to the words "zone of combustion" simply serves to distinguish the hydrogen combustion zone from "second" primary fuel combustion zone in the same claim. It is theoretically possible that a

claim reader might be confused as to which "zone of combustion" was being referred to. The applicant added the words "first" and "second" to the Claim 1 language merely as modifiers to avoid any potential confusion to the reader. They do not add any "new" material to the specification as the original claim 1 also referred to separate combustion zones and are the same basic sequence as presented in the currently amended Claim 1. Therefore, one skilled in the art would be able to read the words "first" and "second" of claim 1 within the context of the seven references in the written description cited above to understand that two distinct combustions zones are described by the inventors and that one occurs prior to the other in the sequence of the method presented herein.

2. Whether the Houseman reference shows all of the limitations of the present invention sufficiently to support a rejection of claims 1, 2, 5, 9, 11, and 12 under 35 U.S.C. §102(b)?

The Examiner rejects Claims 1, 2, 5, 9, 11, and 12 under 35 U.S.C. 102(b) as being anticipated by Houseman.[1] The Examiner further contends that Houseman shows all of the limitations set forth in these claims. However, the present invention cannot be

reasonably be said to be anticipated by Houseman because the devices are *fundamentally* two separate concepts with different purposes, uses, and means. The arguments below show how the language of these rejected claims differ from the Houseman reference.

> Claim 1 - "A method of combusting a liquid primary fuel comprising the steps of:
>
> establishing a first zone of combustion formed by radially inwardly directed intersecting flames comprised essentially of burning hydrogen gas supplied from an external source and spaced from a fuel nozzle,
>
> establishing a second zone of combustion comprising an atomized primary fuel that is ignited by contact with the first zone of combustion.

Each of the underlined words in the above claim 1 is a unique limitation to the present invention and has no corresponding structure in the Houseman reference. These differences are each illustrated below.

First zone - The present invention has two separate combustion "zones", whereas Houseman defines a single combustion "chamber" (See item 56, Fig. 1) where all of the fuel, air and recycle gas are mixed. The first zone is combusting hydrogen gas. The second zone is the combusting liquid fuel and air. Their

[1] USPTO Patent No. 3,982,910 Inventors John Houseman, et. al. (Hereafter referred to as the

separation and distinction is a critical feature of the present invention. The present invention present two distinct combustion zones in an open combustion environment. Houseman shows a single combustion zone inside a confined combustion chamber.

Radially inward directed intersecting flames - The present invention has nozzles that point the hydrogen gas flames toward the axial center of rotation of the burner. Houseman shows two non-rotating helical coils at 17 in Fig. 6 with openings into the combustion chamber that point to the outer walls of the combustion chamber, *exactly opposite* to the present invention.

Burning hydrogen gas - The gas burning in the first combustion zone is of the present invention is hydrogen gas *and hydrogen gas only*. In houseman, the combustion chamber has both hydrocarbon fuel and air and in one embodiment recycled gas from the combustion zone.

External source - The hydrogen being supplied to for the first combustion zone of the present invention is supplied from an external source of hydrogen gas. There simply is no hydrogen gas fed to the Houseman burner from an external source. In

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"Houseman reference).

Figure 7 of Houseman, an embodiment is shown that shows an *internal* recycle stream that contains a range of other gases that merely may include hydrogen. However, the inclusion of hydrogen gas as one of many constituent gases in this internal recycle stream is very different from a stream where the only combustible compound is hydrogen as in the present invention.

Ignited by Contact - This claim limitation is most critical to understanding how the present invention works. The combusting hydrogen flames must be established prior to the spraying of fuel oil in order to ignite the fuel oil. If the hydrogen flames go out or are not present, the device does not function as claimed. Houseman presents a spark plug at 58 (See Figure 5) which is required to start the ignition of the fuel. Although the specification does not appear to say, it is presumed that the spark plug is not needed once the combustion is started and the inner wall becomes hot (i.e., auto-igniting). In the present invention however, the spinning hydrogen flames are the igniter of the fuel oil mixture and must be "on" for the process to work as set forth. These ignited hydrogen flames must be kept intact, stable, and not affected by the spray of fuel oil mixture passing through them. There simply is no corresponding feature like this in the Houseman reference.

Claim 2 The method of claim 1 wherein the first zone of combustion is established by the steps of:

providing a pressurized source of hydrogen (H2) through a conduit having a discharge opening adjacent to said first zone of combustion,

igniting the hydrogen exiting discharged through said discharge opening to produce a hydrogen flame; and

mechanically rotating the hydrogen flame about a longitudinal axis of the first zone of combustion.

In addition to the limitations set forth in Claim 1, to which Claim 2 depends, Claim 2 provides additional limitation that are not present in Houseman. Appellant has underlined at least 3 additional limitations in the reprint of Claim 2 above that are described in more detail below:

Pressurized source of hydrogen - As a basic principal of physics, in order for a gas to flow in a conduit, it must be subjected to a pressure gradient. In the present invention, hydrogen gas is made to flow to the first zone of combustion by generating the hydrogen externally under a positive pressure and connecting the hydrogen generator to the first combustion zone through a plurality of separate conduits from the fuel oil mixture (see items 20 and 21 of Figure 1 of the present invention). This differs substantially from Houseman, which shows the fuel/air mixture flowing into the helical coils and

the space around them before entering into the combustion chamber (see generally Figure 6 and column 5, lines 25-32 of the Houseman reference). First, Houseman does not segregate the air/fuel mixture from the hydrogen stream as does the present invention. Second, Houseman does not send an external hydrogen source into the device as does the present invention.

Hydrogen flame - Houseman's device is designed to generate hydrogen, not combust hydrogen. As a practical matter, a small portion of the combusting gases inside the chamber 56 of Figure 5 (Houseman) might include some combusting hydrogen, but that is not what the specification of the present invention sets forth. The present invention shows a plurality of hydrogen flames, each specially created by sending pressurized hydrogen gas through dedicated conduits, igniting the outlet of each of these conduits and spinning these special conduits. All of this is before the fuel oil mixture is introduced.

mechanically rotating the hydrogen flame - The Examiner unreasonably contends that the stationary device of Houseman satisfies the definition of "mechanically rotating." The definition of word "mechanically", as intended by the inventors, means pertaining to, governed by, or in accordance with, mechanics, or the laws of *motion*. Mechanically rotating the

hydrogen flame has the clear meaning of rotating the hydrogen flame itself. As the specification clearly shows, this also means rotating each of the conduits that carries the hydrogen gas. When the device itself is moving, it cannot reasonably be found the same as a device that is stationary. Appellants believe that the Examiner is relying to heavily on the graphical representation of Houseman's Figure 6, which is technically incorrect and mis-leading. That Figure shows curvy lines extending outwardly from the helical coils intending to represent Houseman's conceptual understanding of what the combusting fuel gas may look like. On closer inspection, one skilled in the art realizes this Houseman's graphical interpretation is in fact a physical impossibility. The gases exiting Houseman's helical coils (see items 70 and 72 of Figure 6) do not have a "memory" of their travel path as the curvy lines extending away from the conduits appear to suggest. Once the gas exits the conduits at 17, it merely continues on a straight line until it reflects off the wall of the cylindrical combustion chamber. Houseman admits this fact in Column 5, lines 32-34, where he states that the flame shapes can be adjusted by changing the angle of the helical coil discharge points relative to the burner axis. Any swirling of Houseman's combustion gases inside device is due to the angle of the discharge conduits and the round shape of the combustion chamber

walls. However, swirling gases in a round combustion chamber are very different from the spinning hydrogen flame nozzles of the present invention. Therefore, the hydrogen flames are spun by means of physical rotation of the hydrogen delivery systems. There is no analogous structure, means or function present in Houseman

The original Claim 5 has been withdrawn as its claim scope was incorporated into the amended Claim 1.

Claim 9 is allowable since it dependent on Claim 1, whose arguments for allowability are incorporated herein. This claim adds the further limitation that the fuel oil is selected from a group.

Claims 11 and 12 are allowable since they dependent on Claim 1, whose arguments for allowability are incorporated herein. These claims relate to the addition of steam or water into the fuel oil mixture at a controlled rate. Although the Houseman specification discloses the use of water or steam to control soot formation, these claim are nonetheless allowable because they carry the same limitations of the claims on which they depend.

3. Whether the method set forth in claims 3, 4, and 6 of the present invention are obvious modifications of the Houseman reference and properly rejected under 35 U.S.C. §103?

The Examiner contends that Claims 3, 4, and 6 of the present invention are obvious in lieu of the Houseman reference. The sole basis for this obviousness rejection, as stated in Examiner's Final Office Action, is that "(Houseman) discloses substantially all of the claimed limitations." However, an obviousness inquiry for purposes of Section 103(a) necessitates an analysis as to whether one skilled in the art could produce the present invention by making obvious modifications to Houseman's device.

With respect to Claims 3, 4, and 6, which relate to the adjustment of rotational speed of the hydrogen flames to accomplish adjustments to the burner for changes in fuel oil type, water content, steam content, and other "tuning" factors when practicing the invention. Applicant respectfully objects to Examiner's assertion as to the obviousness of "speed" and "range" relative to the Houseman reference. First, Houseman does not disclose any rotating mechanical parts to which "speed" and "range of speed" would be relevant. Houseman cannot be used

as a reference for an "obviousness" rejection if it does not teach to do so or otherwise suggest that such a mechanical rotation would result in a useful outcome.

Claims 3, 4, and 6 of the present invention represent a major discovery by the inventors when studying the present invention. Each of these major discoveries is discussed below.

Claims 3 and 6 - Adjusting the speed of the mechanical rotation is an effective means of "tuning" the burner's combustion performance for various fuel types. The Examiner cannot provide any objective evidence to suggest that one skilled in the art would know that adjusting the rotational speed of the hydrogen flames would effect the fuel oil combustion. The Examiner seems to contend that it would be obvious to one skilled in the art to add speed controls to Houseman and adjust them to produce the same device as the present invention. But if Houseman has no means for physical rotation of any part of the burner, then it cannot be said to be obvious since one skilled in the art would have to completely create new elements to the Houseman device in order to even address the issue of speed control.

Claim 4 - This claim is a further limitation of Claim 2, wherein the hydrogen flowing to the first combustion zone Houseman

carries sufficient oxygen to completely combust once outside of the conduit. The Examiner's cursory rejection of this claim under Section 103(a) does not provide a sufficient basis on which to argue the allowability of this claim. Nonetheless, appellants request that arguments distinguishing claim 2 from Houseman (presented previously) also be considered with respect to this claim under Section 103(a).

CLAIMS APPENDIX

1.(currently amended) A method of combusting a liquid primary fuel comprising the steps of:

establishing a first zone of combustion formed by radially inwardly directed intersecting flames comprised essentially of burning hydrogen gas supplied from an external source and spaced from a fuel nozzle,

establishing a second zone of combustion comprising an atomized primary fuel that is ignited by contact with the first zone of combustion.

2.(currently amended) The method of claim 1 wherein the first zone of combustion is established by the steps of:

providing a pressurized source of hydrogen through a conduit having a discharge opening adjacent to said first zone of combustion,

igniting the hydrogen exiting through said discharge opening to produce a hydrogen flame; and

mechanically rotating the hydrogen flame about a longitudinal axis of the first zone of combustion.

3.(withdrawn) The method of claim 2, further comprising the step of setting a speed of the rotating hydrogen flame to optimize a combustion efficiency of the primary fuel.

4.(currently amended) The method of claim 2 where the hydrogen flowing through the conduit includes at least a stoichiometric amount of oxygen to sustain combustion of the hydrogen

5.(withdrawn) The method of claim 2 wherein said discharge opening is radially spaced from said longitudinal axis and angled toward the central axis of rotation.

6.(previously presented) The method of claim 2 wherein a speed of the rotating hydrogen flame in a circumferential direction is not less than the forward flame velocity of the ignited hydrogen.

7.(previously presented) The method of claim 1 wherein said step of dispersing said liquid primary fuel further comprises flowing a pressurized source of liquid primary fuel through a conduit of a rotating shaft and including a discharge end having an

atomizing nozzle to discharge the liquid primary fuel into the zone of combustion.

8. (canceled)

9. (previously presented) The method of claim 1 where said primary fuel is selected from the group comprising processed and unprocessed vegetable oils, by-product oils from agricultural products processing, liquid and liquefied petroleum fuels, and liquid and liquefied animal fats.

10. (currently amended) The method of claim 2 where the step of providing pressurized hydrogen from the hydrogen source further includes the steps of:

generating a constant rate of hydrogen and oxygen gases from the electrolysis of water, and

transferring the hydrogen and oxygen gases into a fixed-volume staging chamber such that the hydrogen and oxygen gases are continuously exposed to an inlet opening of the conduit.

11. (currently amended) The method of claim 1 further including a step of injecting a controlled rate of an additive selected from steam or water into the first zone of combustion.

12.(currently amended) The method of claim 11 wherein the injection of said additive is accomplished by pre-mixing the additive at a controlled rate with the liquid primary fuel.

13.(withdrawn) A burner for combusting a liquid primary fuel and hydrogen comprising:

a rotating shaft with a proximal end and a distal end connected to a burner tip,

a pair of circular hydrogen transport channels formed inside the rotating shaft, each channel having an inlet portion with an inlet port communicating exterior to the shaft for receiving the hydrogen from a source, and an axial portion extending from said inlet portion longitudinally to a burner tip flange,

a primary fuel conduit formed inside the shaft, said conduit having an inlet port for receiving the liquid primary fuel, and an axial portion running perpendicular to the longitudinal axis

of the shaft for transporting the primary fuel from the inlet port to the burner tip flange,

a coolant chamber formed around the shaft closest to the distal end for containing a circulating coolant fluid,

a hydrogen chamber containing a pressurized hydrogen gas source in fluid communication with said hydrogen transport channels , and

a primary fuel chamber containing a pressurized primary liquid fuel in fluid communication with said primary fuel conduit.

14.(canceled)

15.(canceled)

16.(withdrawn) The burner of claim 13 where the axial portion of the hydrogen transport tubes extends away from the longitudinal axis of the shaft at an angle between 10 and 30 degrees relative to the longitudinal axis.

17.(withdrawn) The burner of claim 13 wherein the burner tip is comprised of:

a solid circular flange having a proximal face attached to the end of the shaft, a distal face adjacent to a combustion zone, a hole for passing the liquid primary fuel from the primary fuel conduit and a pair of holes for passing the hydrogen from the hydrogen transport tubes,

a pair of hydrogen discharge tubes extending from the hydrogen holes and projecting away from the distal face of the flange in an axial direction with respect to said shaft, and then in a direction which intersects the longitudinal axis of said shaft; and

a liquid dispersing nozzle disposed at the primary fuel hole for discharging the primary fuel into the combustion zone.

18.(withdrawn) The burner tip of claim 17 where said hydrogen discharge tubes include a first axial portion having a length between 0.5 and 3 inches, an inwardly directed portion having a length between 0.5 and 3 inches, and wherein said axial direction is defined by an angle between 22 and 60 degrees relative to the axial centerline of said axial portion of said hydrogen transport tubes.

19.(withdrawn) The burner of claim 13 further including an electrolytic cell for generating hydrogen and oxygen gases connected to the hydrogen chamber, where the rate of hydrogen being fed to the burner is controlled by varying the surface area of the electrolytic plates and the current input to the electrolytic cell.

20.(withdrawn) The burner of claim 13 further including a fourth chamber around the shaft for staging a secondary material to be injected into a combustion zone, with the shaft including additional transport tubes located therein for transporting the secondary material to the burner tip.

21.(currently amended, withdrawn) The method of claim 1 wherein the first zone of combustion is defined by generally conical surface symmetric about a longitudinal axis.

22.(withdrawn) The method of claim 4 wherein that predetermined mixture of hydrogen is a molar ratio of hydrogen to oxygen having a value of 2:1.

23.(canceled)

24. (currently amended) The method of claim 2 further comprising the steps of providing a second conduit for delivering hydrogen through a second discharge opening adjacent to the first zone of combustion, igniting the hydrogen discharging through said second discharge opening to produce a second hydrogen flame, and rotating said second hydrogen flame about the longitudinal axis.

25. (previously presented) The method of claim 24 further comprising the steps of providing a plurality of additional conduits for delivering hydrogen through additional discharge openings with said additional discharge openings extending radially outward from the longitudinal axis relative to the first two hydrogen discharge openings, igniting the hydrogen discharging through said additional conduits to produce a plurality of hydrogen flames, and rotating said plurality of hydrogen flames about the longitudinal axis in the same rotational direction as said first and second discharge openings.

26. (previously presented) The method of claim 25 where the plurality of additional conduits for delivering hydrogen are rotated in a direction opposite to the first and second conduits along the longitudinal axis.

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EVIDENCE APPENDIX

NONE.

RELATED PROCEEDINGS APPENDIX

NONE.